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COMPARISON OF BODY COMPOSITION OF MOTHERS AND DAUGHTERS WITH DIFFERENT FOOD EATING MODELS

Lidia Wądołowska[1], Kamila Pabjan[2], Małgorzata A. Słowińska[1], Ewa Niedźwiedzka[1]

[1]Department of Human Nutrition, University of Warmia and Mazury in Olsztyn; [2]Nursing and Midwifery, Faculty of Health Science, Świętokrzyska Academy, Kielce

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The nutritional status of mothers and daughters living together in households was analysed in relation to two eating models: moderate (MM) and varied (VM). The study included 97 mother-daughter pairs aged 43.3±6.0 years and 16.0±3.1 years, respectively. The VM mothers in comparison to the MM mothers had greater body mass (by 7.9 kg), which resulted mostly from a higher content of fat tissue (by 4.8 kg). The VM daughters in comparison to the MM daughters were significantly taller (by 3.3 cm), but did not differ in body mass nor body composition. Varied, excessive food consumption was favourable to the fattening of women and faster growing of girls.

INTRODUCTION

Ample studies show a strong influence of the family environment on food intake by children [Burke *et al*., 2001; Feunekes *et al*., 1998; Jeżewska-Zychowicz, 2004; Neumark-Sztainer *et al*., 2003; Story *et al*., 2002], which in turn is determined by various aspects, among which *i.a.* economic and organizational factors play a significant role. However a common household does not forejudge a total similarity of eating habits. The influence of a family environment on children nutrition is more connected with the role and attitudes of mothers than fathers [Feunekes *et al*., 1998; Neumark-Sztainer *et al*., 2003; Story *et al*., 2002]. Women are more sensitive to environmental stimuli that may determine a greater influence of mothers' attitudes on the daughters' eating models [Burke *et al*., 2001; Mosca *et al*., 2006; Van den Bree *et al*., 1999]. Such connections suggest a transfer of eating habits from mothers to daughters, which may influence body condition and health of the girls.

Our previous studies show a significant similarity between food consumption of mothers and their daughters [Wądołowska *et al*., 2007]. Similar eating models were stated for 72% of the mother-daughter pairs, including 51% pairs with "moderate" eating model and 21% pairs for "varied" eating model. Further explanation is needed for the effect of similarities and differences in food intake on the body composition of women and girls. The aim of the undertaken study was, therefore, to analyse body composition of mothers and daughters living in common households in relation to eating models.

MATERIAL AND METHODS

The study included 97 mother-daughter family pairs aged 43.3±6.0 years (from 32.7 to 57.0 years) and 16.0±3.1 years (from 12.0 to 21.0 years), respectively. Women and girls were living in towns and villages of North-Eastern Poland. The sample was chosen by the snowball method. Disorders in nutrition, such as anorexia, were an excluding criterion. One family pair was excluded due to a small reliability of a dietary interview of the daughter. Most mothers and daughters were not on any diet (77.6% and 85.7% of the sample, respectively). Aspiration to maintain slim body was declared by 15.3% of mothers and 8.2% of daughters. Most women had secondary or elementary education (78.6% of the sample), and most daughters were attending a junior high school (85.7% of the sample). The average economic situation of a family was declared by 83.7% of the sample.

Food intake was assessed by the food intake frequency method, using the calibrated FFQ questionnaire. The way of separating eating models (called "moderate" MM and "varied" VM) and similarities analysis in the food intake by mothers and their daughters were described in the previous work [Wądołowska *et al*., 2007].

Women and girls' nutritional status was evaluated by the anthropometrical methods [Heymsfield & Wiliams, 1988; Palczewska & Niedźwiecka, 2001; WHO, 1995]. The following measurements were carried out: weight (kg), height (cm), biceps skinfold thickness (BSF, mm), triceps skinfold thickness (TSF, mm), subscapular skinfold thickness (SCSF, mm), suprailiac skinfold thickness (SISF, mm), waist circumference (cm), hip circumference (cm) and upper arm circumference (AC, cm). Next, calculations were made for: body mass index (BMI, kg/m^2), waist to hip ratio (WHR), upper arm muscle circumference (AMC, cm), upper arm area (AA, mm^2), upper arm muscle area (AMA, mm^2), upper arm muscle index (AMI, %), upper arm fat tissue area (AFTA, mm^2), upper arm

Author's address for correspondence: Lidia Wądołowska, Department of Human Nutrition, University of Warmia and Mazury in Olsztyn ul. Słoneczna 44a, 10-718 Olsztyn, Poland; tel.: (48 89) 523 43 53; e-mail: lidia.wadolowska@uwm.edu.pl

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TABLE 1. Comparison of somatic parameters ($\bar{x}$ ±SD) for mothers and daughters in relation to the eating model.

Parameters	Mothers					Daughters				
	Total N=97	VM N=35	MM N=62	AD	RD (MM=100%)	Total N=95	VM N=33	MM N=62	AD	RD (MM=100%)
Height (cm)	162.9±5.2	163.9±5.4	162.3±5.0	1.6	1.0	164.6±6.9	166.7±6.5	163.4±7.0	3.3[b]	2.0[b]
Weight (kg)	67.7±14.7	72.7±18.3	64.8±11.4	7.9[a]	12.2[a]	54.7±9.9	55.9±8.8	54.0±10.6	1.9	3.5
BMI (kg/m^2)	25.5±5.2	27.0±6.1	24.7±4.4	2.3[a]	9.3[a]	20.1±2.9	20.1±2.7	20.1±3.1	0.0	0.0
BSF (mm)	20.6±8.7	24.0±8.7	18.7±8.1	5.3[a]	28.3[a]	15.9±5.8	15.7±5.6	16.1±6.1	-0.4	-2.5
TSF (mm)	12.2±6.1	14.4±6.3	11.0±5.7	3.4[a]	30.9[a]	9.9±4.3	9.5±3.9	10.2±4.6	-0.7	-6.9
SCSF (mm)	18.4±8.4	20.0±9.0	17.4±7.9	2.6	14.9	12.0±4.5	12.3±4.5	11.8±4.6	0.5	4.2
SISF (mm)	13.8±7.5	16.2±8.1	12.4±6.8	3.8[a]	30.6[a]	11.1±4.7	10.8±4.6	11.2±4.8	-0.4	-3.6
Sum of 4 SF (mm)	65.0±28.3	74.7±29.5	59.5±26.2	15.2[a]	25.5[a]	48.9±16.5	48.2±16	49.3±17.1	-1.1	-2.2
Waist circumference (cm)	82.5±13.1	87.0±15.9	79.9±10.5	7.1[a]	8.9[a]	69.0±7.1	69.7±6.2	68.6±7.6	1.1	1.6
Hip circumference (cm)	98.2±11.9	102.3±14.1	95.8±9.9	6.5[a]	6.8[a]	87.5±9.1	87.1±9.5	87.7±9.1	-0. 6	-0.7
WHR	0.84±0.06	0.85±0.07	0.83±0.06	0.02	2.4	0.79±0.07	0.81±0.08	0.78±0.06	0.03	3.8
AC (cm)	27.1±3.9	28.4±4.4	26.4±3.3	2.0[a]	7.6[a]	22.9±3.0	22.8±3.0	23.0±3.1	-0.2	-0.9
AA (mm^2)	5960±1745	6563±2109	5620±1409	943[a]	16.8[a]	4256±1111	4192±1072	4294±1155	-102	-2.4
AMC (cm)	20.6±2.7	20.8±3.3	20.5±2.2	0.3	1.5	17.9±2.2	17.8±2.4	18.0±2.2	-0.2	-1.1
AMA (mm^2)	3437±902	3541±1179	3379±703	162	4.8	2596±618	2575±659	2610±608	-35	-1.3
AMI (%)	59.3±11.9	54.9±11.4	61.8±11.6	-6.9[a]	-11.2[a]	62.0±9.5	62.1±9.5	62.0±9.8	0.1	0.2
FFM (kg)	44.3±5.5	46.4±7.0	43.1±4.1	3.3[a]	7.7[a]	41.7±8.4	41.5±4.9	41.7±9.9	-0.2	-0.5
AFTA (mm^2)	2523±1261	3022±1361	2241±1116	781[a]	34.8[a]	1660±734	1617±684	1684±775	-67	-4.0
AFI (%)	40.7±11.9	45.1±11.4	38.2±11.6	6.9[a]	18.1[a]	38.0±9.5	37.9±9.5	38.0±9.8	-0.1	-0.3
FM (kg)	23.5±10.0	26.6±11.7	21.8±8.5	4.8[a]	22.0[a]	13.8±4.7	14.0±4.5	13.7±4.9	0.3	2.2
%FM (%)	33.4±7.1	35.0±6.9	32.5±7.0	2.5	7.7	25.4±9.0	26.9±14.2	24.6±4.6	2.3	9.3

$\bar{x}$ – mean value, SD – standard deviation, VM – varying model, MM – moderate model, AD – absolutely difference, RD – relatively difference, BSF – biceps skinfold thickness, TSF – triceps skinfold thickness, SCSF – subscapular skinfold thickness, SISF – suprailiac skinfold thickness, Sum of 4 SF – sum of 4 skinfolds thickness, WHR – waist hip ratio, AC – arm circumference, AA – upper arm area, AMC – upper arm muscle circumference, AMA – upper arm muscle area, AMI – upper arm muscle index, FFM – free fat mass, AFTA – upper arm fat tissue area, AFI – upper arm fat index, FM – fat mass, %FM – percentage of fat mass, a, b – significant differences between mothers' or daughters' subgroups at p≤0.05.

fat index (AFI, %). By the spectrophotometric method, using the FUTREX 6100 apparatus, we determined body composition by assessing the following indices: fat mass (FM, kg), free fat mass (FFM, kg) and percentage of fat mass (%FM, %). In the case of girls standard deviation indices (Z-score) were calculated for the selected somatic parameters, using for the comparisons the growth standards for Warsaw youth [Palczewska & Niedźwiecka, 2001].

For girls no age subgroups were separated, as differences in food intake by younger (12÷15 years) and older (16÷21 years) girls were sparse (concerned mostly coffee, tea and alcohol drinks) and had no influence on their eating models [Wądołowska *et al*., 2007]. Moreover no differences were shown in the age of the VM and MM girls (median 16.0 *vs.* 16.2 years, respectively, $p<0.05$).

The somatic parameters of mothers/daughters with different eating models were compared by the T-test [Hill & Lewicki, 2006]. Differences in somatic indices of mothers/daughters with the varied eating model (VM) and the moderate eating model (MM) were presented as absolute values (AD=VM–MM) and relative values (RD=(VM–MM)×100/MM). Statistical analysis was carried out using the Statistica PL v. 8.0 software.

RESULTS AND DISCUSSION

The VM mothers in comparison to the MM mothers had greater body mass (by 7.9 kg), which was mainly a result of greater body fattening (Table 1). Moreover, the VM mothers had higher mean values of the following parameters: BMI (by 2.3% points), biceps skinfold thickness (by 5.3 mm), triceps skinfold thickness (by 3.4 mm), subscapular skinfold thickness (by 2.6 mm), suprailiac skinfold thickness (by 3.8 mm), sum of 4 skinfolds thickness (by 15.2 mm), waist circumference (by 7.1 cm), hip circumference (by 6.5 cm), arm circumference (by 2.0 cm), upper arm area (by 943 mm^2), free fat mass (by 3.3 kg), upper arm fat tissue area (by 781 mm^2), upper arm fat index (by 6.9% points), fat mass (by 4.8 kg), and smaller upper arm muscle index (by 6.9% points). There were no significant differences in height, WHR, upper arm muscle circumference, upper arm muscle area nor percentage of fat mass.

TABLE 2. Comparison of the Z-score indices ($\bar{x}$ ±SD) for daughters in relation to the eating model.

Z-score indices	Total N=95	VM N=33	MM N=62	AD	RD (MM=100%)
Height	0.2±1.05	0.5±1.1	0.0±1.0	0.5	-2500^b
Weight	0.1±1.1	0.2±1.0	0.0±1.2	0.2	666.7
BMI	0.0±1.1	-0.1±1.0	0.0±1.1	-0.1	0.0
TSF	0.8±1.5	0.7±1.5	0.8±1.6	-0.1	-12.5
SCSF	0.8±1.3	0.9±1.3	0.7±1.2	0.2	28.6
AC	-0.4±1.2	-0.5±1.2	-0.4±1.2	-0.1	25
AMC	-1.1±1.3	-1.2±1.3	-1.1±1.2	-0.1	9.1
AA	-0.3±1.1	-0.4±1.1	-0.3±1.2	-0.1	33.3
AMA	-1.0±1.1	-1.1±1.1	-1.0±1.1	-0.1	10
AFTA	0.4±1.4	0.3±1.3	0.5±1.5	-0.2	-40

Designations as in Table 1.

The VM daughters in comparison to the MM daughters did not differ in body mass nor body composition, but were significantly taller by 3.3 cm (Table 1). Difference in their height was confirmed by the standard deviation index (Z-score), which was higher for the VM daughters by 0.5 SD (Table 2).

The studies showed that women with different eating models had no significant differences in muscle mass. However, the index of upper arm muscle indicates that the VM and the MM women differed in muscle tissue distribution. In total, the VM women had a bit more fat free mass than the MM women, but in the upper arm the muscle tissue in relation to fat tissue was smaller in the VM women. Together with the fat mass indices it suggests that the VM women had much fatter bodies, both in the upper body and in the waist-hip area. Their mean BMI exceeding 25 kg/m^2 (on average 27), waist circumference of almost 88 cm (on average 87) and percentage of the fat mass amounting to 35% show overweight/obesity and a higher metabolic syndrome risk according to the criteria of Yoo *et al.* [2004]. According to the Canadian Guidelines for Body Weight Classification in Adults, the average parameters of the VM women are close to being identified as at high risk of health threats [Douketis, 2005]. The MM women had lower mean body mass, and the BMI, waist circumference and percentage of fat mass usually in the proper range. Higher adiposity of the VM women bodies resulted from greater food consumption, which probably was too big for their organisms. Our previous work demonstrated that the VM mothers consumed 1.7 times more food than the MM mothers (2980 g/day *vs*. 1780 g/day, respectively) [Wądołowska *et al*., 2007]. Results obtained confirm the thesis on increasing adults' body mass along with increased food intake [Jarosz ed., 2006].

Similarly to mothers, the VM girls consumed 1.5 times more foods than the MM girls (2700 g/day *vs*. 1790 g/day, respectively) [Wądołowska *et al*., 2007]. However higher food intake was only favourable to faster growth and did not increase the fat or muscle tissue in relation to their calendar age. The mean standard deviation indices of somatic parameters show it by fitting within the range from -1 SD to 1 SD. This observation confirms that in the case of the youth the overconsumption, but not exceeding the level causing the pathologic energy balance, is responsible for faster growth [Malinowski, 2004; Wells *et al*., 2007]. Still, there is a risk of further development of overweight/obesity and other diet-related diseases for people overfed in earlier stages of life [Davison *et al*., 2005; Ekelund *et al*., 2006; Williams, 2001]. In the future that problem may concern girls with varied eating models, predisposed for overconsumption. In that way, the family environment and mothers' eating models may influence the food intake of daughters and errors in their nutrition, with results that may be visible only in the later stages of life [Burke *et al.,* 2001; Davison *et al*., 2005].

CONCLUSIONS

Our results show that the varied eating model of mothers and daughters was closer to overnutrition than to rational, varied and well-balanced consumption. A result of such a nutritional pattern was increased fat mass in women, which may increase the health risk. The varied eating model was favourable to faster growth of girls, but did not influence an increase in fat or muscle mass in relation to their calendar age. It is likely that for girls the results of varied eating model with predispositions for overconsumption may be seen in later life. In that way, the family environment and errors in mothers' eating models may be favourable to improper nutritional habits of daughters, with results that may be visible at the moment in mothers, but distant in girls.

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